ATTORNEY DOCKET NO. PEARCE 26 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	Charles W. Pearce
Serial No.:	09/755,826
Filed:	January 4, 2001
Title:	A METHOD OF MANUFACTURING A LATERALLY DIFFUSED METAL OXIDE SEMICONDUCTOR DEVICE
Grp./A.U.:	2813
Examiner:	Chen, Jack S.

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Mail Stop Appeal Brief-Patents

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March 22, 2004 Elizabeth Schumacher
Date of Mailing Signature of person mailing

ATTENTION: Board of Patent Appeals and Interferences

Sirs:

APPELLANT'S BRIEF UNDER 37 C.F.R. §1.192

This is an appeal from a Final Rejection dated December 29, 2003, of Claims 1-20. The Appellant submits this Brief in triplicate as required by 37 C.F.R. §1.192(a), with the statutory fee of $ 330.00 as set forth in 37 C.F.R.§1.17(c), and hereby authorizes the Commissioner to charge any

additional fees connected with this communication or credit any overpayment to Deposit Account No. 08-2395.

This Brief contains these items under the following headings, and in the order set forth below in accordance with 37 C.F.R. §1.192(c):

I. **REAL PARTY IN INTEREST**

II. **RELATED APPEALS AND INTERFERENCES**

III. **STATUS OF CLAIMS**

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X. **APPENDIX A - CLAIMS**

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is the Assignee, Agere Systems, Inc.

II. RELATED APPEALS AND INTERFERENCES

No other appeals or interferences will directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 1-20 are pending in this Application.

IV. STATUS OF THE AMENDMENTS

The present Application was filed on January 4, 2001. The Appellants filed a first Amendment on January 23, 2003, in response to an Examiner's Action mailed October 24, 2002. The Examiner entered the Amendment and subsequently issued a second Examiner's Action on April 8, 2003. The Appellant then filed a second Amendment on July 8, 2003, in response to the Examiner Action mailed on April 8, 2003. The Examiner entered the second Amendment and subsequently issued a Final Rejection on September 24, 2003. The Appellants then filed a Request for Reconsideration on November 24, 2003. The Examiner indicated that the Request for

Reconsideration had overcome the objection to the specification and the rejection under 35 U.S.C. §112, first paragraph, but did not place the Application in condition for allowance. The Appellants then filed a Notice of Appeal on January 26, 2004.

V. SUMMARY OF THE INVENTION

The present invention is directed, in general, to a semiconductor device and, more specifically, to a method of manufacturing a laterally diffused metal oxide semiconductor (LDMOS) device. In one embodiment, the method includes forming a lightly-doped source/drain region 310 between first and second isolation structures 215, wherein with the lightly-doped source/drain region 310 only includes a first dopant. The method further includes creating a gate 410 over the lightly-doped source/drain region 310. As illustrated in FIGUREs 3 & 4 (reproduced here as Illustration 1 & Illustration 2) the lightly-doped source/drain region 310 is formed prior to the formation of the gate 410.

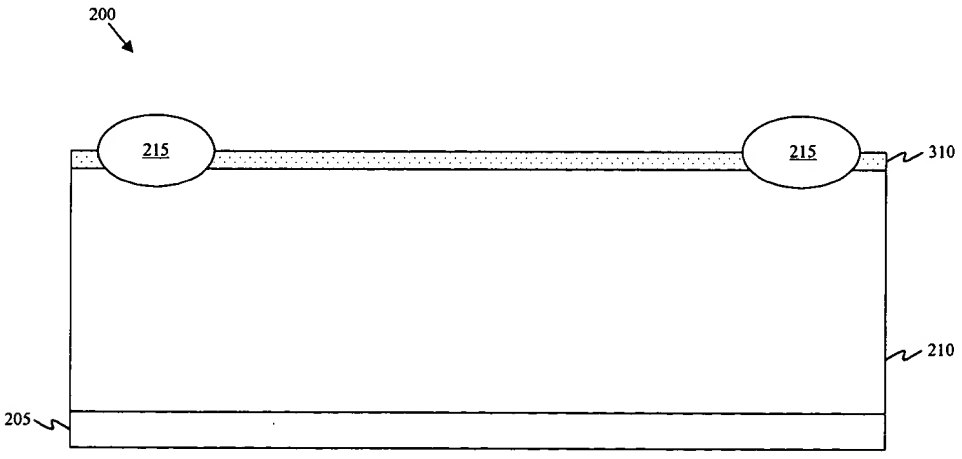

FIGURE 3

Illustration 1

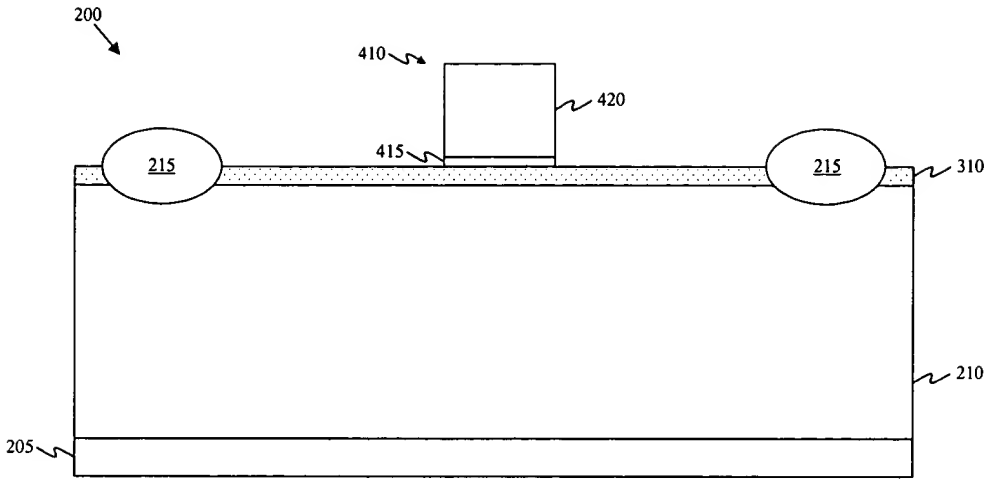

FIGURE 4

Illustration 2

VI. ISSUES

1) The first issue presented for consideration in this appeal is whether Claims 1-3, 5, 6, 8, 10, 11-13, 15, 16, 18, and 20, as rejected by the Examiner, are anticipated in accordance with 35 U.S.C. §102(e) by U.S. Patent No. 6,255,154 B1 to Akaishi, *et al.* (Akaishi).

2) The second issue presented for consideration in this appeal is whether Claims 4, 7, 9, 14, 17, and 19, as rejected by the Examiner, are patentably nonobvious in accordance with 35 U.S.C. §103(a) over Akaishi.

VII. GROUPING OF THE CLAIMS

Claims 1-20 do not stand or fall together. Independent Claims 1 and 11 form a first group. The dependent Claims form the following groups: Claims 2 and 12 form a second group, Claims 3 and 13 form a third group, Claims 4 and 14 form a fourth group, Claims 5 and 15 form a fifth group, Claims 6 and 16 form a sixth group, Claims 7 and 17 form a seventh group, Claims 8 and 18 form an eighth group, Claims 9 and 19 form a ninth group, and Claims 10 and 20 forms a tenth group.

VIII. PRIOR ART

A. Akaishi

Akaishi, as shown in Illustration 3 below (FIG. 1 of Akaishi) is directed to method of manufacturing a semiconductor device which can satisfy the requirements of reduced "on" resistance. Akaishi teaches that a drift region 22 is formed in a well 21 and over a substrate 1. The drift region 22, as taught by Akaishi, includes two dopants. For example, Akaishi teaches that its drift region 22 requires both an Arsenic 32 and Phosphorous 33 dopant for creation thereof. (See, column 4, lines 9-22, FIG. 2 of the Akaishi reference). Akaishi further teaches that a gate 7A is formed over the drift region 22. Subsequent to forming the gate 7A, Akaishi teaches forming LDD structures. (See, FIGUREs 6-8 and associated description at column 6, lines 13-50).

FIG.1

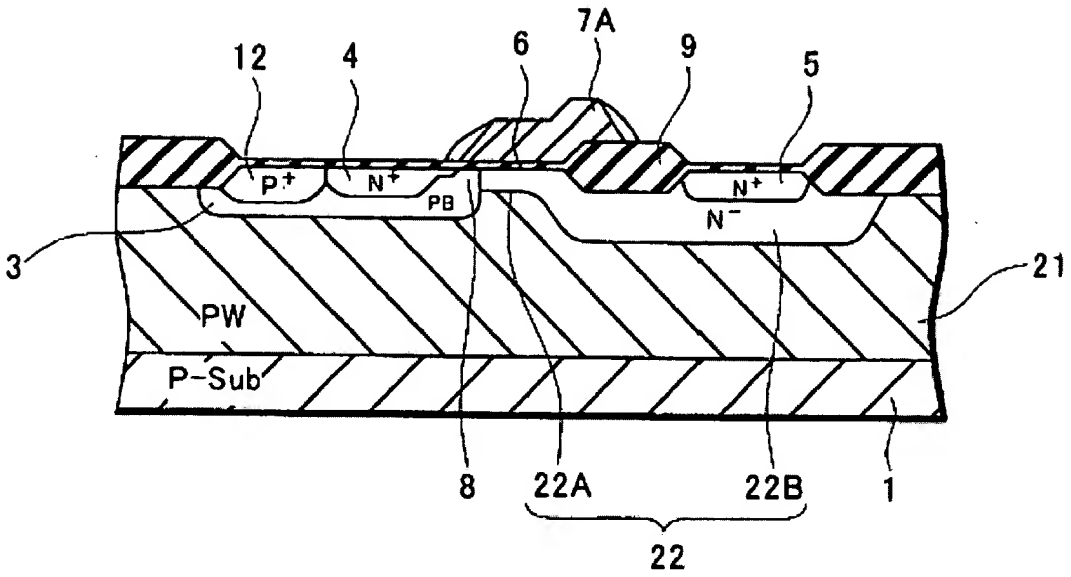

Illustration 3

IX. THE APPELLANT'S ARGUMENTS

The inventions set forth in independent Claims 1 and 11, and their respective dependent claims, are neither anticipated by nor made obvious from the references on which the Examiner relies.

A. Rejection of Claims 1 and 11 under 35 U.S.C. §102

Akaishi fails to anticipate independent Claims 1 and 11, and their dependent claims, because Akaishi fails to disclose every element of independent Claims 1 and 11. Specifically, Akaishi fails

to disclose the claimed element of forming a lightly-doped source/drain region with only one dopant prior to the formation of the gate.

The Examiner continues to assert that the drift region 22 of Akaishi is actually a lightly-doped source/drain region, as claimed by the present invention. Nonetheless, as discussed at column 4, lines 15-18, of the Akaishi reference, "the N–type impurities serve to form an N layer 22 constituting a drift region in later steps." Therefore, layer 22 does not actually constitute a lightly doped source/drain region, but a drift region.

In actuality, Akaishi specifically teaches that its LDD structures are formed after formation of the gate 7A, however, prior to forming the side wall spacers 36. (See, FIGUREs 6-8 and associated description at column 6, lines 13-50). This step is in direct contrast to what is presently claimed in independent Claims 1 and 11. As recited above, independent Claims 1 and 11 require that the gate be created over the lightly-doped source/drain regions. By nature, this requires that the lightly-doped source/drain regions be formed prior to formation of the gate. Such is clearly not the case in the Akaishi reference.

However, assuming arguendo that the drift region of Akaishi could be considered a lightly-doped source/drain region, it requires both an Arsenic 32 and Phosphorous 33 dopant for creation thereof. (See, column 4, lines 9-22, FIG. 2 of the Akaishi reference). Akaishi then states that "[t]hese N–type impurities serve to form an N layer 22 constituting a drift region in later steps." (See, column 4, lines 15-17, FIG. 2 of the Akaishi reference). As Akaishi requires at least two dopants to form its drift region and Claims 1 and 11 require that only a single first dopant be used for the formation of its lightly-doped source/drain regions, Akaishi fails to teach this element.

The Examiner is also attempting to parse the drift region 22 into portions 22A and 22B by arguing that Akaishi teaches forming lightly doped source/drain region 22A with only a first dopant (in this case, the dopant only having N–type conductivities and the only dopant is the N–type dopant). As regions 22A and 22B collectively form the drift region 22, if 22A were to function as a lightly doped source/drain region, 22B would also function as a lightly doped source/drain region. Therefore, the lightly doped source/drain region 22 of Akaishi, if it could be called that, would be formed using at least two dopants. As indicated above, this is contrary to that presently claimed in independent Claims 1 and 11.

Nevertheless, regardless of whether the Examiner is asserting the LDD region of Akaishi is the lightly-doped source/drain region or the drift region 22 of Akaishi is the lightly-doped source/drain region, Akaishi fails to disclose the claimed element that the lightly-doped source/drain region is formed using only one dopant and is formed prior to the formation of the gate. Therefore, Akaishi does not disclose each and every element of the claimed invention and as such, is not an anticipating reference for independent Claims 1 and 11.

B. Rejection of Claims 2 and 12 under 35 U.S.C. §102

The Examiner has rejected Claims 2 and 12 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 2 and 12 additionally require that the lightly-doped source drain region be doped with a first N-type dopant. Akaishi, however, does not disclose that the lightly-doped source drain region be doped with a first N-type dopant in combination with the base claim limitations. Therefore, Akaishi does not disclose each and every element of Claims

2 and 12. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 2 and 12.

C. Rejection of Claims 3 and 13 under 35 U.S.C. §102

The Examiner has rejected Claims 3 and 13 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 3 and 13 additionally require that the first N–type dopant has an implant dose ranging from about 1E12 atoms/cm^2 to about 1E13 atoms/cm^2. Akaishi, however, does not disclose that the first N–type dopant has an implant dose ranging from about 1E12 atoms/cm^2 to about 1E13 atoms/cm^2 in combination with the base claim limitations. Therefore, Akaishi does not disclose each and every element of Claims 3 and 13. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 3 and 13.

D. Rejection of Claims 5 and 15 under 35 U.S.C. §102

The Examiner has rejected Claims 5 and 15 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 5 and 15 additionally require diffusing a second dopant at least partially across the lightly-doped source/drain region and under the gate to form a first portion of a channel. Akaishi, however, does not disclose diffusing a second dopant at least partially across the lightly-doped source/drain region and under the gate to form a first portion of a channel in combination with the base claim limitations. Therefore, Akaishi does not disclose each and every

element of Claims 5 and 15. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 5 and 15.

E. Rejection of Claims 6 and 16 under 35 U.S.C. §102

The Examiner has rejected Claims 6 and 16 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 6 and 16 additionally require diffusing a P-type dopant having an implant dose ranging from about 1E13 atoms/cm^2 to about 1E14 atoms/cm^2. Akaishi, however, does not disclose diffusing a P-type dopant having an implant dose ranging from about 1E13 atoms/cm^2 to about 1E14 atoms/cm^2 in combination with the base claim limitations. Therefore, Akaishi does not disclose each and every element of Claims 6 and 16. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 6 and 16.

F. Rejection of Claims 8 and 18 under 35 U.S.C. §102

The Examiner has rejected Claims 8 and 18 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 8 and 18 additionally require placing a heavy concentration of the first dopant in a region adjacent a source side of the gate, and in the lightly-doped source/drain region adjacent a drain side of the gate. Akaishi, however, does not disclose placing a heavy concentration of the first dopant in a region adjacent a source side of the gate, and in the lightly-doped source/drain region adjacent a drain side of the gate in combination with the base

claim limitations. Therefore, Akaishi does not disclose each and every element of Claims 8 and 18. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 8 and 18.

G. Rejection of Claims 10 and 20 under 35 U.S.C. §102

The Examiner has rejected Claims 10 and 20 under 35 U.S.C. §102(e) as being anticipated by Akaishi. The above argument establishing the novelty of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 10 and 20 additionally require placing an implant dose of the first dopant ranging from about 1E15 atoms/cm^2 to about 1E16 atoms/cm^2 in a region adjacent the source/drain region. Akaishi, however, does not disclose placing an implant dose of the first dopant ranging from about 1E15 atoms/cm^2 to about 1E16 atoms/cm^2 in a region adjacent the source/drain region in combination with the base claim limitations. Therefore, Akaishi does not disclose each and every element of Claims 10 and 20. Thus, the Appellant respectfully requests that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 10 and 20.

H. Rejection of Claims 4 and 14 under 35 U.S.C. §103

Akaishi also fails to render obvious the elements of independent Claims 1 and 11, and their dependent claims, because Akaishi fails to teach or suggest every element of independent Claims 1 and 11.

As established above, Akaishi fails to teach the element that a lightly-doped source/drain region including only one dopant is formed prior to the formation of the gate. Similarly, Akaishi

fails to suggest this element. As Akaishi specifically teaches that its drift region 22 is formed using at least two dopant types, as indicated above, Akaishi fails to suggest that only a single first dopant be used for the formation of its lightly-doped source/drain regions, as required by independent Claims 1 and 11.

Thus, Akaishi fails to teach or suggest the invention recited in independent Claims 1 and 11. Accordingly, it fails to establish a prima facie case of obviousness with respect to Claims 1 and 11. Claims 1 and 11 are therefore not obvious in view of Akaishi.

The Examiner has rejected Claims 4 and 14 under 35 U.S.C. §103(a) as being unpatentable over Akaishi. Dependent Claims 4 and 14 additionally require that the first N–type dopant has an implant dose of about 5E12 atoms/cm^2. Akaishi, however, does not teach or suggest that the first N–type dopant has an implant dose of about 5E12 atoms/cm^2 in combination with the base claim limitations. Thus, Akaishi does not establish a *prima facie* case of obviousness of dependent Claims 4 and 14. Accordingly, Claims 4 and 14 are nonobvious over Akaishi and the Appellants respectfully request that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 4 and 14.

I. Rejection of Claims 7 and 17 under 35 U.S.C. §103

The Examiner has rejected Claims 7 and 17 under 35 U.S.C. §103(a) as being unpatentable over Akaishi. The above argument establishing the nonobviousness of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 7 and 17 additionally require that the second dopant includes an implant dose about 100 times higher than an implant dose of the first dopant. Akaishi, however, does not teach or suggest that the second dopant includes an implant dose

about 100 times higher than an implant dose of the first dopant in combination with the base claim limitations. Thus, Akaishi does not establish a *prima facie* case of obviousness of dependent Claims 7 and 17. Accordingly, Claims 7 and 17 are nonobvious over Akaishi and the Appellants respectfully request that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 7 and 17.

J. Rejection of Claims 9 and 19 under 35 U.S.C. §103

The Examiner has rejected Claims 9 and 19 under 35 U.S.C. §103(a) as being unpatentable over Akaishi. The above argument establishing the nonobviousness of independent Claims 1 and 11 is incorporated herein by reference. Dependent Claims 9 and 19 additionally require that a heavy concentration of the first dopant in the lightly-doped source/drain region be located from about 2000 nm to about 3000 nm from the drain side of the gate. Akaishi, however, does not teach or suggest that a heavy concentration of the first dopant in the lightly-doped source/drain region be located from about 2000 nm to about 3000 nm from the drain side of the gate in combination with the base claim limitations. Thus, Akaishi does not establish a *prima facie* case of obviousness of dependent Claims 9 and 19. Accordingly, Claims 9 and 19 are nonobvious over Akaishi and the Appellants respectfully request that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of Claims 9 and 19.

For the reasons set forth above, the Claims on appeal are not anticipated by Akaishi. Further, the Claims are patentably nonobvious over Akaishi. Accordingly, the Appellant respectfully requests

that the Board of Patent Appeals and Interferences reverse the Examiner's Final Rejection of all of the Appellant's pending claims.

Respectfully submitted,

Hitt Gaines, P.C.

Greg H. Parker
Registration No. 44,995

Dated: 3-22-04

Hitt Gaines, P.C.
P.O. Box 832570
Richardson, Texas 75083-2570
(972) 480-8800
(972) 480-8865 (Fax)
E-Mail: greg.parker@hittgaines.com

X. APPENDIX A - CLAIMS

1. A method of manufacturing a laterally diffused metal oxide semiconductor (LDMOS) device, comprising:

forming a lightly-doped source/drain region with only a first dopant, the lightly-doped source/drain region located between first and second isolation structures; and

creating a gate over the lightly-doped source/drain region.

2. The method as recited in Claim 1 wherein forming includes forming a lightly-doped source/drain region with a first N–type dopant.

3. The method as recited in Claim 2 wherein the first N–type dopant has an implant dose ranging from about 1E12 atoms/cm^2 to about 1E13 atoms/cm^2.

4. The method as recited in Claim 3 wherein the first N–type dopant has an implant dose of about 5E12 atoms/cm^2.

5. The method as recited in Claim 1 further including diffusing a second dopant at least partially across the lightly-doped source/drain region and under the gate to form a first portion of a channel.

6. The method as recited in Claim 5 wherein diffusing the second dopant includes diffusing a P-type dopant having an implant dose ranging from about 1E13 atoms/cm^2 to about 1E14 atoms/cm^2.

7. The method as recited in Claim 5 wherein diffusing the second dopant includes diffusing a P-type dopant having an implant dose about 100 times higher than an implant dose of the first dopant.

8. The method as recited in Claim 5 further including placing a heavy concentration of the first dopant in a region adjacent a source side of the gate, and in the lightly-doped source/drain region adjacent a drain side of the gate.

9. The method as recited in Claim 8 wherein placing includes placing the heavy concentration of the first dopant in the lightly-doped source/drain region a distance ranging from about 2000 nm to about 3000 nm from the drain side of the gate.

10. The method as recited in Claim 8 wherein placing includes placing an implant dose of the first dopant ranging from about 1E15 atoms/cm^2 to about 1E16 atoms/cm^2.

11. A method of manufacturing an integrated circuit, comprising:

fabricating laterally diffused metal oxide semiconductor (LDMOS) transistors, including:

forming a lightly-doped source/drain region with only a first dopant, the lightly-doped source/drain region located between first and second isolation structures; and

creating a gate over the lightly-doped source/drain region;

depositing interlevel dielectric layers over the LDMOS transistors; and

creating interconnect structures in the interlevel dielectric layers and interconnecting the LDMOS transistors to form an operative-integrated circuit.

12. The method as recited in Claim 11 wherein forming includes forming a lightly-doped source/drain region with a first N–type dopant.

13. The method as recited in Claim 12 wherein the first N–type dopant has an implant dose ranging from about 1E12 atoms/cm^2 to about 1E13 atoms/cm^2.

14. The method as recited in Claim 13 wherein the first N–type dopant has an implant dose of about 5E12 atoms/cm^2.

15. The method as recited in Claim 11 further including diffusing a second dopant at least partially across the lightly-doped source/drain region and under the gate to form a first portion of a channel.

16. The method as recited in Claim 15 wherein diffusing the second dopant includes diffusing a P-type dopant having an implant dose ranging from about 1E13 atoms/cm^2 to about 1E14 atoms/cm^2.

17. The method as recited in Claim 15 wherein diffusing the second dopant includes diffusing a P-type dopant having an implant dose about 100 times higher than an implant dose of the first dopant.

18. The method as recited in Claim 15 further including placing a heavy concentration of the first dopant in a region adjacent a source side of the gate, and in the lightly-doped source/drain region adjacent a drain side of the gate.

19. The method as recited in Claim 18 wherein placing includes placing the heavy concentration of the first dopant in the lightly-doped source/drain region a distance ranging from about 2000 nm to about 3000 nm from the drain side of the gate.

20. The method as recited in Claim 18 wherein placing includes placing an implant dose of the first dopant ranging from about 1E15 atoms/cm^2 to about 1E16 atoms/cm^2.